

Einstein

The Passionate Adventurer

by D.D.Kosambi

"That's our Professor Einstein", said the American taxi-driver with tenderness and pride rare in his notoriously disrespectful clan. The recipient of this accolade was clumping vigorously along the Princeton sidewalk one gloomy December afternoon in 1948. The famous mane of hair, now white and thinner, was still unprotected by a hat. Shirt and necktie had been replaced by a sailor's knit jersey, socks dispensed with altogether.

This was an unforgettable first glimpse of the man whose theories had evoked the complete spectrum of comment from derision to adulation. The simplicity of his dress was matched by his bearing at all times, even in scientific discussion. His life, however, had not been as tranquil as his aspect. This pioneer citizen of a new universe had had to change his earthly citizenship several times. Germany, the country of his birth and education, denied him full effectiveness because he was Jew. Zionism, which he tried so hard to serve, did not gain because he took the advice of people without vision. His personal judgment of scientific merit came to be regarded as worthless, for anyone could prey upon his abundant kindness to obtain a superlative testimonial.

Popularly labeled the world's greatest to the really great mathematicians and greatest mathematician, of his day such as Dedekind, Poincaré, Hilbert. The imputation that he was the father of the atom bomb led him to say bitterly towards the end of his life that if it were to do over again, he would prefer to be a plumber or a tramp rather than a scientist. He did write the letter that let President Roosevelt to allocate funds for the immediate development of nuclear chain reactions. Not he but other Princeton colleagues brought their talents to bear upon the technical development of the A-Bomb and the H-Bomb, heedless of the disaster to humanity. It is stated that it is his equation $E = mc^2$ led inevitably to atomic warfare. This is true to about the same extent that the Sermon on the Mount led inevitably to the sack of Constantinople in the Fourth Crusade.

Einstein's great achievement was a completely new way of looking at the material universe. The amount of matter in space at any time affects the properties of space itself, and also the measurement of time. Other radically new scientific ideas that characterize the first half of our century crystallized rapidly about the theory of relativity.

The fine mechanical system developed by Newton and his successors had begun to show small but clear and unmistakable flaws by the end of the 19th century. The planet Mercury did not move with the proper clockwork accuracy. Both electricity and magnetism obeyed Newton's inverse square law, just like gravitation; but what was the connection between them and gravity? Ultimate particles of matter carried electro-magnetic charges. Why did they send out electromagnetic waves - light - as gravitation did not? Why was the velocity of that light completely unaffected by the earth's rapid movement through space? If mass and energy were indestructible, how did the Curies' new element Radium constantly shoot off particles as well as the x-rays discovered by Roentgen? Man's search for new sources of power and energy was being blocked by outworn notions of matter.

Einstein helped solve more than one of these problems, but his main work developed out of the question: why does light travel with a speed independent of its source? He turned the question about, and said that the constant velocity of light is a fundamental property of empty space. Two observers at a distance could compare their watches and yardsticks only by flashing light signals whose velocity remained the same for both, no matter how they moved. This leads to entirely new concepts of measurement and simultaneity. It also relates mass and energy, which become two interchangeable aspects of the same thing.

Philosophers and theologians dragged in the Bible, Karl Marx, and immortality of not yet forgotten. He alone saw beyond mere verbal controversy. Some new, powerful tool was needed for the analysis of time and space. Not only had all major known facts to be explained, but it was essential to predict phenomena not as yet

observed. This tool was discovered by him in the work of two Italian mathematicians' Ricci and Levi-Civita. Its use had to be mastered painfully. Then came the "passionate adventure into the unknown" upon which he looked back as filling the finest years of his life: the precise mathematical formulation of the unity of space, time, and matter. The sublime exaltation of such discovery has to be experienced. It cannot be explained to those who seek it in mescaline, or the ascent of impassible mountain peaks. He took good care to associate competent mathematicians with his work. The insight, however, was his alone. So many of us produced beautiful and intricate formulae without knowing what to do with them, while he thought his way slowly to Nature's secrets.

The first magnificent result was published during the early years of that senseless slaughter, the First World War. The new theory explained not only Newton's gravitational law, but also the curious behavior of Mercury. There was a spectacular prediction, that a ray of light passing close to the sun would be bent slightly. As light has no mass, Newton's theory could not explain this; even if the rays did have weight, the deflection by Newton's theory would be only half that given by Einstein. Special observations made during solar eclipses confirmed the Einstein law. The theory passed thereafter as current coin into the common treasury of man's knowledge.

It was not in astronomy but in the opposite direction that the influence of relativity was indispensable. What happened inside the atom received a better explanation. Einstein went on to combine gravitation with electromagnetism in a succession of theories, over the years 1929-1949. When it appeared that virtually no solutions existed of his final equations, he had the courage to face possible ruin of twenty years' hard work: "Perhaps, my dear colleague, Nature does not obey differential equations after all". The solutions were found later by Hlavaty. However, Nature still has the Last word. The inexhaustible properties of matter continually revealed by experiments in nuclear physics have outstripped all theories.

It seems to me that we now stand close to the threshold of a new life, as far above any pre-atomic utopia as that was above the early Stone Age. If we really cross the threshold into a new age, it will be by renouncing war and greed for individual profit. Then indeed may our descendants abandon this little cinder of a planet for really brave new worlds in unbounded space. Busy with the creation of real history, they might no longer be conscious of their historical past. But one of the individuals who led us nearer to the threshold was the passionate adventurer - Einstein.